DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS-R6-ES-2011-0019]

[4500030113]

Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the Arapahoe Snowfly as Threatened or Endangered

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notice of 12-month petition finding.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a 12-month finding on a petition to list the Arapahoe snowfly (*Capnia arapahoe*) as endangered and to designate critical habitat under the Endangered Species Act of 1973, as amended (Act). After review of the best available scientific and commercial information, we find that listing the Arapahoe snowfly as threatened or endangered is warranted. Currently,

however, listing the Arapahoe snowfly is precluded by higher priority actions to amend the Lists of Endangered and Threatened Wildlife and Plants. Upon publication of this 12-month petition finding, we will add the Arapahoe snowfly to our candidate species list. We will develop a proposed rule to list the Arapahoe snowfly as our priorities allow. We will make any determination on critical habitat during development of the proposed listing rule. In any interim period, we will address the status of the candidate taxon through our annual Candidate Notice of Review.

DATES: The finding announced in this document was made on [INSERT DATE OF FEDERAL REGISTER PUBLICATION].

ADDRESSES: This finding is available on the Internet at *http://www.regulations.gov* at Docket Number **FWS-R6-ES-2011-0019**. Supporting documentation we used in preparing this finding is available for public inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Colorado Field Office, 134 Union Blvd., Suite 670, Lakewood, CO 80228. Please submit any new information, materials, comments, or questions concerning this finding to the above street address.

FOR FURTHER INFORMATION CONTACT: Susan Linner, Field Supervisor, Colorado Field Office (see **ADDRESSES**); by telephone at 303–236–4773, or by facsimile at 303–236–4005. If you use a telecommunications device for the deaf (TDD), please call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Background

Section 4(b)(3)(B) of the Act (16 U.S.C. 1531 *et seq.*) requires that, for any petition to revise the Federal Lists of Threatened and Endangered Wildlife and Plants that contains substantial scientific or commercial information that listing a species may be warranted, we make a finding within 12 months of the date of receipt of the petition. In this finding, we will determine that the petitioned action is: (1) not warranted, (2) warranted, or (3) warranted, but the immediate proposal of a regulation implementing the petitioned action is precluded by other pending proposals to determine whether species are endangered or threatened, and expeditious progress is being made to add or remove qualified species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Section 4(b)(3)(C) of the Act requires that we treat a petition for which the requested action is found to be warranted but precluded as though resubmitted on the date of such finding, that is, requiring a subsequent finding to be made within 12 months. We must publish these 12-month findings in the **Federal Register**.

Previous Federal Actions

On July 30, 2007, we received a petition from Forest Guardians (now WildEarth Guardians), requesting that the Service consider for listing as either endangered or threatened 206 species in our Mountain-Prairie Region ranked as G1 or G1G2 by the

organization NatureServe (except those that are currently listed, proposed for listing, or candidates for listing). The Arapahoe snowfly was 1 of the 206 species included in the petition. On March 19, 2008, WildEarth Guardians filed a complaint indicating that the Service failed to make a preliminary 90-day finding on their two multiple-species petitions-one for mountain-prairie species, and one for southwestern species. We subsequently published two 90-day findings, including one on February 5, 2009 (74 FR 6122) for the mountain-prairie species. That finding concluded that the petition did not present substantial scientific or commercial information indicating that listing may be warranted for 165 of the 206 species, including the Arapahoe snowfly.

On April 6, 2010, we received a petition, of the same date, from The Xerces Society for Invertebrate Conservation, Dr. Boris Kondratieff, Save the Poudre: Poudre Waterkeeper, Cache la Poudre River Foundation, WildEarth Guardians, and Center for Native Ecosystems, requesting that the Arapahoe snowfly be listed as endangered and that critical habitat be designated under the Act. Supporting information regarding the species' taxonomy and ecology, population distribution and status, and actual and potential causes of decline was included in the petition. We acknowledged the receipt of the petition in a letter to Scott Hoffman Black and the other petitioners dated April 13, 2010. In that letter, we stated that issuing an emergency regulation temporarily listing the species under section 4(b)(7) of the Act was not warranted. We also stated that, due to previously received petitions, court orders, other listing actions with statutory deadlines, and judicially approved settlement agreements that would take the remainder of Fiscal Year 2010 to complete, we anticipated responding to the petition in Fiscal Year 2011.

On December 1, 2010 the petitioners filed a Notice of Intent to sue regarding our failure to complete a 90-day finding concerning their April 6, 2010, petition to list the Arapahoe snowfly.

On April 26, 2011, we published a 90-day finding for the Arapahoe snowfly (76 FR 23256). In that finding, we found that the petition presented substantial information to indicate that listing the species may be warranted. On June 27, 2011, we received a Notice of Intent to sue from Mile High Law Office for not completing a 12-month finding on the April 6, 2010, petition to list the species. This Notice of Intent to sue was submitted on behalf of WildEarth Guardians, Save the Poudre: Poudre Waterkeeper, Center for Native Ecosystems, and Colorado State University. On September 9, 2011, a settlement agreement with WildEarth Guardians was approved in U.S. District Court that included a multiyear listing workplan for several species, including a commitment to complete a 12-month finding for the Arapahoe snowfly in Fiscal Year 2012. This notice constitutes the 12-month finding on the April 6, 2010, petition to list the Arapahoe snowfly as endangered and fulfills our commitment for the Arapahoe snowfly under the September 9, 2011, settlement agreement.

Species Information

Taxonomy

The Arapahoe snowfly is an insect in the order Plecoptera (stonefly), the family Capniidae (small winter stonefly), and the genus *Capnia* (snowfly) (NatureServe 2009, p. 1; Integrated Taxonomic Information System 2010, p. 1). In North America, there are 674 known species of stoneflies, including 56 species of *Capnia* (Stark *et al*. 2009, pp. 3–4). The nearest relatives of the Arapahoe snowfly are the Utah snowfly (*C. utahensis*) and the Sequoia snowfly (*C. sequoia*), both of which are a minimum of 400 miles (mi) (640 kilometers (km)) from the known locality for Arapahoe snowfly (Nelson and Kondratieff 1988, p. 79). The Arapahoe snowfly was first discovered in 1986 and identified as a new species in 1988 (Nelson and Kondratieff 1988, p. 77). The scientific community accepts the current taxonomic status of the Arapahoe snowfly (Nelson and Kondratieff 1988, p. 77; Nelson and Baumann 1989, p. 314; Stark *et al.* 2009, p. 3; Integrated Taxonomic Information System 2010, p. 1). Consequently, we conclude that the Arapahoe snowfly is a valid species and, therefore, a listable entity under section 3(16) of the Act.

Species Description

Stoneflies are distinguished by the ability to fold their two pairs of wings back along the abdomen; however, none fly well (Williams and Feltmate 1992, pp. 33 and 35). Most stoneflies are inconspicuous insects that fly clumsily (Hynes 1976, p. 135). Species of *Capnia* are typically distinguished from other genera by physical characteristics of the epiproct (a projection at the end of the abdomen) (Nelson and Baumann 1989, p. 312). The Arapahoe snowfly adult is dark colored and has a body length of approximately 0.2

inches (in.) (5 millimeters (mm)) and a wing length of also approximately 0.2 in. (5 mm) (Nelson and Kondratieff 1988, p. 77). The immature (nymph) stage has not been described.

Habitat

The Arapahoe snowfly has been documented only in two streams: Young Gulch and Elkhorn Creek in Colorado (Nelson and Kondratieff 1988, p. 77). Both streams are small tributaries of the Cache la Poudre River and are typical of streams in the Front Range of the Rocky Mountains of Colorado in that they are characterized by intermittent flow and a substrate of pebble, cobble, and bedrock (Nelson and Kondratieff 1988, p. 79). Upper reaches of both streams are typified by steep slopes with ponderosa pine (*Pinus ponderosa*) (Nelson and Kondratieff 1988, p. 79). Lower reaches near the confluences with the Cache la Poudre River, where the species has been collected, have gentler slopes, with cottonwood (*Populus angustifolia*), willow (*Salix* spp.), Rocky Mountain maple (*Acer glabrum*), chokecherry (*Padus virginiana*), and alder (*Alnus incana*) trees along the stream margins (Colorado State University 2010, p. 1). Elevations at collection sites are 5,800 feet (ft) (1,768 meters (m)) at Young Gulch and 6,600 ft (2,010 m) at Elkhorn Creek (Nelson and Kondratieff 1988, p. 77). Both stream reaches with records of Arapahoe snowfly are within the Canyon Lakes Ranger District of the Roosevelt National Forest and managed by the U.S. Forest Service (USFS). There also are some private land holdings in upstream reaches of both drainages.

Stoneflies are primarily associated with clean, cool, running waters (Surdick and Gaufin 1978, p. 3; Brittain 1990, p. 1; Williams and Feltmate 1992, p. 35; Palma and Figueroa 2008, p. 81; Stewart and Stark 2008, p. 311). Water temperature is a major influence on stonefly growth and development (Brittain 1983, p. 445). Stonefly nymphs tend to have specific water temperature, substrate type, and stream size requirements that are reflected in their distribution along stream courses and the timing of their emergence in the spring (Stewart and Stark 2008, p. 311). Their restriction to cool, clean habitats with considerable water movement, all of which contribute to high dissolved oxygen concentrations, is thought to be connected to high dissolved oxygen requirements of the nymphs (Williams and Feltmate 1992, p. 39; Heinold 2010, p. 17). Winter stonefly nymphs undergo diapause (dormancy) in the hyporheic zone-an active interface between the surface stream and groundwater with exchanges of water, nutrients, and dissolved oxygen (Boulton *et al*. 1998, p. 59; Hancock 2002, p. 763). The hyporheic zone is vulnerable to changes in the quality and quantity of both surface water and groundwater (Hancock 2002, p. 763). Exchange between surface water and groundwater may be the most important regulator of biological activity in the hyporheic zone; without flow to renew nutrients and oxygen and flush wastes, the sediments become unsuitable habitat (Hancock 2002, p. 764). Human activities that can impact the hyporheic zone include water diversions, sedimentation from roads and trails, wastewater inputs, and livestock grazing (Hancock 2002, p. 765).

The species of aquatic macroinvertebrates present in a watershed are an important indicator of the long-term health of that watershed (Fleming 1999, pp. 93–94; DeWalt *et*

al. 2005, p. 942). Stoneflies are considered the order of insects most sensitive to habitat alteration, pollution, and siltation, and are the best insect indicators of aquatic environmental quality (Baumann 1979, p. 241; Rosenberg and Resh 1993, p. 354; Fleming 1999, p. 94; Heinold 2010, p. 18). With increased stream disturbances, the number of stonefly taxa has been shown to decrease (Barbour *et al*. 1999, pp. 7.15–7.16). Fleming (1999, p. 94) developed a tolerance index for aquatic macroinvertebrates from 1 to 10, with 10 being most tolerant. Stoneflies were the least tolerant to stream perturbation, with a tolerance index ranging from 1.7 to 4.4 for the various families (Fleming 1999, p. 94). The family of small winter stoneflies, of which the Arapahoe snowfly is a member, was in the mid-range, with a tolerance index of 3.0 (Fleming 1999, p. 94).

We are not aware of any surface water quality data for Young Gulch, and there is minimal data for Elkhorn Creek. After work on this finding was initiated, the Service and the USFS undertook a cooperative effort to collect field data for both streams. However, Young Gulch was dry at the time of sampling (December 8, 2011). Consequently, data was only collected for Elkhorn Creek. Sampling was just above the confluence of the creek with the Cache la Poudre River. The winter season and the need for a short turn-around time on laboratory results in order to meet publication deadlines for the 12-month finding limited the amount of data collected. However, from what we know of winter stoneflies, the parameters shown in Table 1 appear adequate to support the species during early winter. These data are described in the following table (Sanchez 2011a, p. 2; 2011b, pp. 2, 14).

TABLE 1. Water quality data collected from Elkhorn Creek (December 8, 2011).

Parameter	**Measurement**
Water temperature	32.5 °F (0.3 ºC)
Conductivity	150.9 microsiemens per centimeter (µs/cm)
pH	6.46
Dissolved oxygen	11.18 milligrams per liter (mg/L) (>90%)
Total inorganic nitrogen	<0.21 mg/L
Ammonium	<0.10 mg/L
Total suspended solids	<5 mg/L
Total dissolved solids	88–96 mg/L
Total coliform	present

A study that included the Cache la Poudre River tested for the presence of 271 compounds, including volatile organic compounds, pesticides, wastewater compounds, and *Escherichia coli* (Collins and Sprague 2005, p. 1). Most (257) of these compounds were not detected in the river, and all concentrations detected were less than established water quality standards (Collins and Sprague 2005, p. 1). The river is considered generally pristine (Medley and Clements 1998, p. 632; George Weber Environmental, Inc. 2007, p. 7). Based upon what is known regarding habitat requirements of the Arapahoe snowfly, the mainstem of the Cache la Poudre River is not likely to be habitat for the species due to the fact that known and historical occurrences were both found in small, intermittent streams.

Life History

Few studies have been conducted on the Arapahoe snowfly due to its rarity and relatively recent discovery. Sampling for adult specimens is limited to late winter/early

spring when adults are present above ground. Snowflies generally cannot be identified at the species level during most of their life history stages, including the nymph stage. The difficulties in distinguishing among species of snowfly nymphs and sampling under ice in winter have largely precluded the study of individual species (Stewart and Stark 2002, p. 122). Detailed life histories are well known for less than 5 percent of stonefly species (Stewart and Stark 2002, p. 23). Therefore, most of the information below comes from knowledge about stoneflies (order Plecoptera) in general, other members of the small winter stonefly family, and other species of the genus *Capnia*. We expect that the life history of the Arapahoe snowfly would be similar to these closely related species.

Stoneflies have a complex lifecycle that requires terrestrial habitat during the adult phase and aquatic habitat during the nymph phase (Lillehammer *et al*. 1989, p. 183; Williams and Feltmate 1992, p. 33). Having both a terrestrial and aquatic phase creates dependence on two different environments (Brittain 1990, p. 1). The majority of the stonefly life cycle is spent as a developing nymph in the aquatic environment, while their brief terrestrial adult stage of 3 to 4 weeks is primarily focused on reproduction (Brittain 1990, p. 1; Williams and Feltmate 1992, p. 33). Winter stoneflies have a univoltine (1-year) life cycle (Hynes 1976, pp. 146–147).

As water levels fall through late winter, adult winter stoneflies emerge from the space that forms under stream ice and crawl onto the snow or nearby vegetation (Hynes 1976, pp. 135-36). Winter streamflow is essential for successful egg deposition (Jacobi and Cary 1996, p. 696). Water temperature also is important, with emergence occurring

earlier in warmer years (Hynes 1976, p. 137). Arapahoe snowfly adults have been collected only in late March and early April (Mazzacano undated, p. 2). After emergence, winter stonefly males drum (beat their abdomen on the ground or on vegetation) to search for mates, with a frequency that is species and sex specific (Hynes 1976, p. 139). Unmated females reply, the males approach and drum again, and the process repeats until they meet and mate (Hynes 1976, p. 139). Mating occurs on the ground or on vegetation adjacent to the aquatic habitat (Brittain 1990, p. 1). Females release eggs over the surface of the flowing stream, and the eggs attach to the cobble and gravel in the stream substrate (Stewart and Stark 2008, p. 311).

Most stoneflies lay 100 to 2,000 eggs (Brittain 1990, p. 4). Winter stonefly eggs hatch within 3 to 4 weeks (Stewart and Stark 2008, p. 312). Hatching success is high within a water temperature range of 41 to 59 ºF (5 to 15 ºC) (Brittain 1990, p. 5). Most stoneflies show rapidly decreasing hatching success over 68 ºF (20 ºC) (Brittain 1990, p. 5). As water temperatures rise, nymphs burrow into the streambed and undergo summer diapause (Harper and Hynes 1970, pp. 925–926; Williams and Feltmate 1992, p. 39; Stewart and Stark 2002, p. 34; Mazzacano undated, p. 2). This behavior enables winter stoneflies to inhabit streams that may reach unsuitably high temperatures or dry up during the summer (Harper and Hynes 1970, pp. 925–926; Stewart and Stark 2002, p. 34). Diapause also may be a mechanism for synchronizing the timing of feeding with leaf drop in the fall (Stewart and Stark 2002, p. 35). As water temperatures drop in the fall, nymphs emerge from the hyporheic zone into the stream water and become more active. Most winter stonefly nymphs are shredders (feeding on organic detritus such as falling leaves that is deposited into streams), and active nymphs are usually found in leafy or

woody stream debris (Short and Ward 1981, p. 341; Mazzacano undated, p. 2; Stewart and Stark 2008, p. 379).

Stoneflies have limited dispersal capability (Brittain 1990, pp. 2 and 10). This lack of mobility prevents them from crossing even small ecological barriers and has led to a high degree of local speciation (Hynes 1976, p. 135). A study in the United Kingdom that collected more than 22,500 adult stoneflies of 15 different species found that half of all stoneflies were taken within 59 ft (18 m) of the stream channel, and 90 percent traveled less than 197 ft (60 m) (Petersen *et al*. 2004, pp. 934, 938, and 942). Most studies also suggest a low tendency of in-stream drift for stonefly nymphs (Stewart and Szczytko 1983, p. 117).

Historical Distribution

Many snowflies are endemic species, with a narrow range limited to a small geographical or ecological area (Nebeker and Gaufin 1967, p. 416; Nelson and Baumann 1989, p. 292; Nelson 2008, pp. 178–179; Kondratieff and Baumann 2002, p. 399). Similarly, the Arapahoe snowfly appears to have a highly restricted distribution. It is historically known from only two small tributaries of the Cache la Poudre River in northern Colorado–Young Gulch and Elkhorn Creek (Nelson and Kondratieff 1988, p. 77; Heinold and Kondratieff 2010, p. 282). Habitat where the species has been collected extends from the confluences with the river to approximately 1,640 ft (500 m) upstream for both streams (Heinold 2011a, unpaginated). Searches further upstream have failed to

locate the species (Heinold 2011a, unpaginated). Approximately 5 mi (8 km) separates these two streams. The species was first discovered in March 1986 in Young Gulch, but, despite repeated searches during most of the past 25 years, it has not been found again in that locale (Nelson and Kondratieff 1988, p. 77; Heinold 2011b and 2011c, unpaginated). In April 1987, the species was first located in Elkhorn Creek and has been found in subsequent searches in this stream (Nelson and Kondratieff 1988, p. 77). Repeated searches (at least 17 searches in the past 16 years) also have been conducted in 11 additional nearby waterways with similar ecological characteristics; however, the species has not been located in any of these streams (Heinold 2011b, unpaginated). Thus, the species is currently known from just one extant location and we consider it to be extirpated from Young Gulch.

Since the species was collected in Young Gulch only on one occasion, we do not know if there was actually a historical population there, what the size of that population was, or why it was extirpated. However, Young Gulch has several characteristics that may make it less desirable than Elkhorn Creek as Arapahoe snowfly habitat. Young Gulch is a shorter stream, which originates at a lower elevation (7,500 ft (2,290 m)) than Elkhorn Creek (10,000 ft (3,050 m)). Thus, any accumulated snowfall in the upper reaches of the drainage will melt sooner and more quickly, which in turn would result in the drying of the stream earlier in the year than Elkhorn Creek. There is no minimum flow water right on Young Gulch, as there is on Elkhorn Creek (Colorado Water Conservation Board (CWCB) and Colorado Division of Water Resources (CDWR) 2011,

unpaginated). As noted above, when water samples were collected from Elkhorn Creek in Arapahoe snowfly habitat on December 8, 2011, Young Gulch was dry.

The other major difference between the two streams is the amount of recreational use. Young Gulch has a well-developed trailhead off of Highway 14 that, according to the USFS, experiences heavy, year-round usage, including hikers, bikers, backpackers, and horseback riders (USFS 2011c, pp. 1, 2). The 4.5-mi (7.2-km) trail follows Young Gulch and includes approximately 45 stream crossings (Casamassa 2011, p. 4). Aquatic macroinvertebrate species present at a given stream site are related to the number of stream crossings above that site, with the total number of larval species (including stoneflies) negatively related to the number of stream crossings (Gucinski *et al*. 2001, p. 26). The amount of usage and the number of stream crossings likely contribute to a high sediment load, which may have factored into the extirpation of the species at this location.

Current Distribution, Abundance, and Trends

The species is known from 1 male specimen collected in 1986 in Young Gulch, 1 male in 1987, 10 males and 2 females in 2009, and 1 male in 2011, all in Elkhorn Creek (Heinold and Kondratieff 2010, p. 281; Heinold 2011d, unpaginated). We consider Elkhorn Creek to be the only currently occupied habitat. During a search of Elkhorn Creek on March 17, 2009, approximately 500 specimens of 4 species in the genus *Capnia* were collected, but only 5 of those specimens were Arapahoe snowfly (Heinold 2011a,

unpaginated). We consider this low degree of detection to indicate rarity of the Arapahoe snowfly at the only known remaining location for the species.

Given the low numbers of individuals that have been collected over the years, we have no information available regarding population trends for the Arapahoe snowfly. However, we consider it extirpated from one of the two streams where it was historically known to occur. It appears to currently have an extremely narrow distribution near the confluence of one small stream, and it is rare within its only known occupied habitat.

Summary of Information Pertaining to the Five Factors

Section 4 of the Act (16 U.S.C. 1533) and implementing regulations (50 CFR 424) set forth procedures for adding species to, removing species from, or reclassifying species on the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, a species may be determined to be endangered or threatened based on any of the following five factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

In making this finding, information pertaining to the Arapahoe snowfly in relation to the five factors provided in section 4(a)(1) of the Act is discussed below. In considering what factors might constitute threats to a species, we must look beyond the exposure of the species to a particular factor to evaluate whether the species may respond to that factor in a way that causes actual impacts to the species. If there is exposure to a factor and the species responds negatively, the factor may be a threat and, during the status review, we attempt to determine how significant a threat it is. The threat is significant if it drives, or contributes to, the risk of extinction of the species such that the species warrants listing as endangered or threatened as those terms are defined in the Act. However, the identification of factors that could impact a species negatively may not be sufficient to compel a finding that the species warrants listing. The information must include evidence sufficient to suggest that these factors are operative threats that act on the species to the point that the species may meet the definition of endangered or threatened under the Act.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range.

Under this factor we evaluate climate change, recreation, development, forest management, and grazing.

Climate Change

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Stream Effects

The western United States is being affected by climate change more than any other part of the United States outside of Alaska (Saunders *et al*. 2008, p. iv). The hydrological cycle of the western United States changed significantly over the second half of the 20th century (Barnett *et al*. 2008, p. 1080). Numerous studies show more winter precipitation falling as rain instead of snow, earlier snowmelt, and associated

changes in river flow (Barnett *et al*. 2008, p. 1080). Between 1978 and 2004, the spring pulse (onset of streamflow from melting snow) in Colorado shifted earlier by 2 weeks (Ray *et al*. 2008, p. 2). Although there is no identified decrease in runoff to date, average annual runoff is projected to decrease significantly for the South Platte River basin (which includes Elkhorn Creek) over the next 50 to 60 years (U.S. Bureau of Reclamation (BOR) 2011, p. 94). A decline of 8 percent is projected by the 2020s, 14 percent by the 2050s, and 17 percent by the 2070s, due primarily to increased temperatures and little projected change in precipitation (BOR 2011, p. 94).

A precipitous decline in lower elevation snowpack below 8,200 ft (2,500 m) elevation is predicted to occur across the western United States by the middle of the 21st century, and modest declines of 10 to 20 percent are projected to occur in snowpack above 8,200 ft (2,500 m) elevation (Regonda *et al*. 2005, p. 376; Ray *et al*. 2008, p. 1). The headwaters of Elkhorn Creek approach 10,000 ft (3,050 m) elevation, indicating that Elkhorn Creek may begin to experience some effects from reduced snowpack within the next 50 years.

A local habitat that depends on snowmelt to maintain a sufficient quantity of in-stream flows is likely to be sensitive to projected reductions in average snowpack, as well as to changes in the timing and intensity of precipitation (Glick *et al*. 2011, p. 20). Species that breed in intermittent streams are likely to be highly susceptible to climate impacts from changes such as rising temperature regimes; winter precipitation arriving more frequently as rain than snow; and shifts in the timing of snowmelt, runoff, and peak

stream flows (Glick *et al*. 2011, p. 41). Species that are poor dispersers also may be more susceptible as they will be less able to move from areas where the effects of climate change render those areas unsuitable and into areas that become newly suitable (Glick *et al*. 2011, p. 49). The Arapahoe snowfly is found in a localized habitat, breeds in an intermittent stream, and is considered a poor disperser. Consequently, it may be particularly vulnerable to the effects of climate change.

Temperature has critical effects on aquatic macroinvertebrates through its combined influences on dissolved oxygen and metabolic activity (Durance and Ormerod 2007, p. 943). The stonefly's restriction to cool, clean habitats with considerable water movement is thought to be connected to high dissolved oxygen requirements of the nymphs (Williams and Feltmate 1992, p. 39; Heinold 2010, p. 17). Stoneflies' adaptation to cold environments places them at a competitive disadvantage in warmer climates (Brittain 1990, p. 9; Haiderkker and Hering 2007, p. 473). A study in the United Kingdom found that spring macroinvertebrate abundance declined by an average rate of 21 percent across all species for every 1.8 ºF (1 ºC) rise in stream temperature in circumneutral (pH near neutral) streams (Durance and Ormerod 2007, p. 942). Sixteen species of stoneflies were among the 84 macroinvertebrate species noted in these streams (Durance and Ormerod 2007, p. 951). Air temperatures in the northern Front Range of Colorado increased 2.5 ºF (1.4 ºC) in the period 1977–2006 (Ray *et al.* 2008, p. 10). Stream temperatures also are expected to increase as the climate warms (Ray *et al*. 2008, p. 41).

In a study conducted over a 25-year period in the United Kingdom, scarcer taxa of macroinvertebrates disappeared in circumneutral (pH near 7) streams that showed progressive temperature increases (Durance and Ormerod 2007, p. 943). There is limited pH data specific to Elkhorn Creek. However, in 1973 the USFS recorded a pH of 7.5 in Elkhorn Creek headwaters and also near the confluence of Elkhorn Creek with the Cache la Poudre River (USFS 1973, p. 1). More recently, a pH of 6.46 was recorded in Elkhorn Creek near the confluence with the Cache la Poudre River (Sanchez 2011, p. 2). These pH values are circumneutral, and similar to pH values in the study. Thus, currently observed increasing trends in temperature for Elkhorn Creek might adversely impact the Arapahoe snowfly.

A laboratory study found that larval growth of one species of stonefly (*Leuctra nigra*) increased with increasing water temperature from 43 to 68 ºF (5.9 to 19.8 ºC); however, mortality also increased, resulting in only 7 to 10 percent of individuals completing their life cycle at the three higher temperatures, compared with 23 to 27 percent at the three lower temperatures (Elliot 1987, p. 181). The number of eggs laid also decreased at higher temperatures (Elliot 1987, p. 181). As previously noted, air temperatures in the northern Front Range of Colorado increased 2.5 ºF (1.4 ºC) in the period 1977–2006 and stream temperatures also are expected to increase (Ray *et al*. 2008, pp. 10 and 41). This suggests that water temperatures in Elkhorn Creek could increase to levels harmful to sensitive taxa such as the Arapahoe snowfly.

Terrestrial Effects

Disturbances such as insect outbreaks and wildfire are likely to intensify in a warmer future with drier soils and longer growing seasons (Field *et al*. 2007, p. 619; Karl *et al*. 2009, p. 82). Ongoing outbreaks of mountain pine beetle (*Dendroctonus ponderosae*) in Colorado are probably caused primarily by climate, specifically drought and high temperature (Romme *et al*. 2006, p. 4; Black *et al*. 2010, p. 1). Mountain pine beetles typically exist as small populations that feed on the innermost bark layer of trees that have been weakened by disease or injury (Black *et al*. 2010, p. 7). However, they can erupt to epidemic levels if stand structure and climatic conditions are appropriate and overcome the defenses of even healthy trees, leading to widespread mortality of host species (Field *et al*. 2007, p. 623; Black *et al*. 2010, p. 7).

Ponderosa pine is the dominant vegetation in the upper watershed of Elkhorn Creek (Nelson and Kondratieff 1988, p. 79). Mountain pine beetle infestations are building in ponderosa pine forests along the Front Range of Colorado, with an outbreak detected in northern Larimer County (Ciesla 2010, pp. 2, 10, and 34). This outbreak encompasses the range of the Arapahoe snowfly. Infestations in ponderosa pine along the Northern Front Range increased by more than 10-fold from 2009 to 2010, from 22,000 acres (ac) (8,903 hectares (ha)) to 229,000 ac (92,673 ha) (Ciesla 2011, pp. 6–7). Mountain pine beetle activity is expected to increase in the Front Range over the next several years (Ciesla 2011, p. 8). The mountain pine beetle outbreak in northern Colorado could affect water quantity and quality. As trees die and fall, forest cover

becomes less dense, allowing greater exposure of snowpack to solar radiation, causing faster, earlier runoff and a resultant potential increase in soil erosion (Ciesla 2010, p. 17).

Epidemics that kill trees over large areas also provide dead, desiccated fuels for large wildfires (Field *et al*. 2007, p. 623). A warming climate encourages wildfires through a longer summer period that dries fuels, promoting easier ignition and faster spread (Field *et al*. 2007, p. 623). In the last 3 decades, the wildfire season in the western United States increased by 78 days (Saunders *et al*. 2008, p. 20). Fire suppression during the 20th century is believed to have created a high hazard of catastrophic fire in ponderosa pine forests of the northern Front Range in Colorado (Veblen *et al*. 2000, p. 1178). Catastrophic fire can impact aquatic macroinvertebrates. For example, following fires in Yellowstone National Park in 1988, there was a change in aquatic macroinvertebrates from shredder and collector species (such as snowflies) to scraper and filter-feeding species (Neary *et al*. 2009, p. 142). Similarly, following the 1996 Dome wildfire in New Mexico, aquatic macroinvertebrate shredders (including winter stoneflies) common in pre-fire years were reduced or eliminated, and had not recovered by 5 years post-fire (Vieira *et al*. 2004, pp. 1243 and 1251). Taxa with weak dispersal abilities and specialized feeding requirements (including winter stoneflies) became rare after the Dome wildfire (Vieira *et al*. 2004, p. 1256). A wildfire in the Elkhorn Creek watershed has a similar potential to eliminate rare macroinvertebrates such as the Arapahoe snowfly.

In conclusion, the effects of climate change will likely modify Arapahoe snowfly habitat in several ways including: (1) the predicted significant reduction in snowpack; (2) the present increase in temperature as well as continued threatened increases in future years; (3) the present and increasing outbreak of mountain pine beetle in ponderosa pine; and (4) the threatened increased likelihood of wildfire. Although available information indicates that climate change could potentially be modifying the species' habitat at the present time, we do not have any information that indicates this is currently threatening the species. However, the impacts from each of these stressors are reasonably expected to increase into the future, and the species' limited distribution and life history characteristics make it extremely vulnerable to the predicted impacts. Therefore, we consider modification of habitat as a result of climate change to be a threat to the species.

Recreation

Recreation has been increasing in the northern Front Range as a result of increasing population growth in Colorado (USFS 2009b, p. 1). The nearest city is Fort Collins, Colorado, approximately 31 mi (50 km) from Elkhorn Creek. Fort Collins' population has grown rapidly in recent years. The 2006 population estimate was 129,467, an 8.7 percent increase from 2000 (City of Fort Collins 2008b, unpaginated). The 2010 population estimate was 143,986, an 11.2 percent increase from 2006 (City of Fort Collins 2011, unpaginated). Usage of trail systems throughout the Cache la Poudre River canyon will likely increase as the population continues to grow.

Specific information on the types of recreational usage for Elkhorn Creek is not available, but we expect that there would be similar usage patterns to nearby Young Gulch, where the USFS estimates that approximately 83 percent of recreational users were day-hikers, 10 percent bicyclists, 4 percent back-packers, and 1 percent horseback riders (Casamassa 2011, p. 5). Dogs are often allowed off-leash on USFS trails, including Elkhorn Creek trails (Casamassa 2011, p. 5). Common environmental impacts associated with trail usage include vegetation loss, soil compaction, erosion, muddiness, degraded water quality, and disruption of wildlife (International Mountain Biking Association (IMBA) 2007, p. 1; Marion and Wimpey 2007, unpaginated). The environmental degradation caused by hikers and mountain bikers is similar; both are substantially less than degradation caused by horses (Marion and Wimpey 2007, unpaginated). Eroded soils that enter streams increase sedimentation that can impact habitat directly or contribute to algae blooms that deplete dissolved oxygen (IMBA 2007, p. 8). Even localized disturbance can harm rare species (Marion and Wimpey 2007, unpaginated). Since Arapahoe snowfly nymphs require high dissolved oxygen levels (see Habitat section), algal blooms could indicate dissolved oxygen levels unsuitable for Arapahoe snowfly habitation.

A new trailhead was completed midway along Elkhorn Creek in 2010 that expanded the parking area and improved trail access (USFS 2009b, p. 4). Consequently, trail usage is likely to increase along the lower section of Elkhorn Creek in and near Arapahoe snowfly habitat. There are several areas along upper sections of Elkhorn Creek where trails are causing increased run-off and erosion (USFS 2009a, p. 48).

Consequently, the USFS has identified 14 stream crossings for improvement (Casamassa 2011, p. 3). These trails originate 6 to 7 mi (10 to 11 km) upstream from where the Arapahoe snowfly has been found and progress further upstream, away from known Arapahoe snowfly habitat. We have no information at this time to indicate that sedimentation from these trails is impacting downstream Arapahoe snowfly habitat. Therefore, at present, we do not consider recreational use within the Elkhorn Creek watershed to be a threat to the species.

Development

The number of species of stoneflies as well as the percentage of stoneflies compared with all insect species decreases with increasing stream perturbations (Barbour *et al*. 1999, pp. 7.15–7.16). Roads, water diversions, and wastewater inputs are the primary development activities occurring in the Elkhorn Creek watershed.

Roads

Road construction and use can result in large increases in suspended sediments, with potentially detrimental effects on water quality and aquatic macroinvertebrates (Anderson and Potts 1987, p. 681; Gucinski *et al*. 2001, p. vii; Grace 2002, p. 13; Angermeir *et al*. 2004, p. 19). A number of studies have demonstrated declines in invertebrate densities and biomass following sedimentation events by directly affecting aspects of their physiology or by altering their habitat (Anderson 1996, p. 8). Arapahoe

snowfly nymphs inhabit the hyporheic zone in spaces between and beneath large substrate particles such as pebbles and cobbles. Sediment can clog these spaces, cementing the stream bottom, inhibiting the flow of dissolved oxygen, and making the habitat unsuitable for macroinvertebrate species such as stoneflies (Furniss *et al*. 1991, p. 302; Waters 1995, p. 65; Anderson 1996, pp. 6 and 8; Grace 2002, pp. 24–25). The aquatic macroinvertebrate species present at a given stream site are inversely related to the number of stream crossings above that site, with the total number of larval species (including stoneflies) decreasing with an increasing number of stream crossings (Gucinski *et al*. 2001, p. 26).

There are several areas along Elkhorn Creek where roads are causing increased run-off and erosion into the stream; consequently, the USFS rates the watershed as Class II or "at risk" (exhibiting moderate integrity relative to its potential condition and at risk of being able to support its beneficial uses) (USFS 2009a, p. 48). Unpaved roads create compacted, bare areas that increase runoff and erosion (USFS 2009a, p. 48). In addition, some road segments near Elkhorn Creek are steep and severely eroded (USFS 2009a, p. 48). Road density in the area averages 3.5 mi of roads per square mi (2.2 km per square km); a road density of 3.7 mi per square mi (2.3 km per square km) is considered high (USFS 2009a, p. A-1). Unpaved roads and jeep trails cross the Elkhorn Creek watershed approximately 20 times, according to topographic maps. One additional road crossing is by a paved road. Unpaved roads, constructed of native materials (such as gravel and sand), are more erosion prone than paved roads. All unpaved road crossings are upstream from Arapahoe snowfly habitat. The closest stream crossing by an unpaved road is

approximately 5 to 6 mi (8 to 10 km) upstream of known occupied habitat for the species. Given the distance of the unpaved road crossings from the species' habitat, the sediment may be settling out before reaching occupied habitat. Additionally, during the winter, there is likely less traffic and the ground is frozen, both of which may result in less sediment erosion. We cannot identify any impacts to the species from the available water quality information.

Road salts are a common pollutant in regions with snowy winters and can enter air, soil, groundwater, and surface water from runoff, surface soils, or wind-borne spray (Center for Environmental Excellence 2009, p. 3; Silver *et al*. 2009, p. 942). Stoneflies are very sensitive to water salinity, with adverse effects apparent at low salinities (Hart *et al*. 1991, p. 136). However, the Colorado Department of Transportation concluded that magnesium chloride (the road salt used in Colorado Mountains) is highly unlikely to cause environmental damage at distances greater than 59 ft (18 m) from a roadway (Lewis 1999, p. vii; Center for Environmental Excellence 2009, p. 4). Highway 14 crosses Elkhorn Creek at its confluence with the Cache la Poudre River. Habitat for the Arapahoe snowfly extends from the confluence with the river to approximately 1,640 ft (500 m) upstream (Heinold 2011a, unpaginated). Therefore, based on the Colorado Department of Transportation's conclusion, approximately 3.6 percent of potential habitat may be impacted by the use of road salt. Sampling on December 8, 2011, within this 1,640-ft (500-m) reach in Elkhorn Creek detected very low salinity levels (Sanchez 2001b, p. 2). Based upon the small percentage of stream habitat that could potentially be

impacted and the low salinity levels detected during the one sampling event, we do not consider the use of road salt to be a threat to the Arapahoe snowfly.

In conclusion, roads are contributing to an unacceptable sediment load resulting in the Elkhorn watershed being rated as Class II or "at risk." However, these roads are a minimum of 5 mi (8 km) upstream of the species' occupied habitat, and we have limited downstream water quality information in the vicinity of Arapahoe snowfly habitat to confirm or refute impacts. We believe that use of road salts causes minimal impact to the species' habitat. Therefore, at present, we do not consider roads to be a threat to the species.

Water Diversions

Elkhorn Creek and 2 of its tributaries contain 35 water diversion structures, 23 of which have active water rights (CWCB and CDWR 2011, unpaginated). Diversion rights totaling rates of approximately 50 cubic feet per second (cfps) (1.4 cubic meters per second (cmps)) plus an additional volume of approximately 205 acre-feet (252,800 cubic meters) are permitted (CWCB and CDWR 2011, unpaginated). A minimum flow of 2 cfps (0.06 cmps) for Elkhorn Creek is included among the active water rights (CWCB and CDWR 2011, unpaginated). This minimum flow indirectly provides some protection to habitat of the Arapahoe snowfly. However, Elkhorn Creek is described as an intermittent stream (Nelson and Kondratieff 1988, p. 79), and during periods of low precipitation it may be dry, despite in-stream flow water rights. The species' life history

includes a diapause stage that allows it to inhabit streams which may become dry during the year due to high temperatures or low flows (Harper and Hynes 1970, pp. 925–926; Stewart and Stark 2002, p. 34).

In the upstream reach of the Cache la Poudre River that includes the confluence of Elkhorn Creek, water inputs and outputs tend to balance out (City of Fort Collins 2008a, p. 5). Further downstream, below the mouth of the Cache la Poudre Canyon, there are numerous water depletions (City of Fort Collins 2008a, pp. 5–6). However, the downstream river reach does not have an impact on the amount of water in Elkhorn Creek.

Several water diversions on Elkhorn Creek or its tributaries have modified or curtailed habitat for the Arapahoe snowfly. However, a minimum flow of 2 cfps for Elkhorn Creek is included among the active water rights, and information on other species of winter stoneflies indicates that diapause enables them to withstand naturally dry summer conditions. Therefore, at present, we do not consider water diversions to be a threat to the species.

Wastewater

The two largest known wastewater inputs within the Elkhorn Creek watershed are a Boy Scout camp (camp) located approximately 5 to 6 mi (8 to 10 km) upstream of known occupied habitat for the Arapahoe snowfly and a meditation and yoga retreat

(retreat) located approximately 6 to 7 mi (10 to 11 km) upstream. Both facilities have septic tanks and constructed wetlands or evaporation ponds for treating wastewater prior to discharge into the groundwater basin within the Elkhorn Creek watershed (North Front Range Water Quality Planning Association 2011, unpaginated). Both the camp and the retreat are building treatment facilities that will further reduce the possibility of wastewater entering Elkhorn Creek (North Front Range Water Quality Planning Association 2011, unpaginated). With these precautions, we conclude that contamination of the Arapahoe snowfly habitat by wastewater from the camp or retreat is unlikely and therefore, not a threat to the species.

None of the streams in the project area are listed on the State Clean Water Act (CWA) section 303(d) list as impaired. However, groundwater monitoring wells installed both up-gradient and down-gradient from the retreat's wastewater treatment site show that all parameters, with the exception of chloride, had their lowest values (i.e., highest water quality) in groundwater up-gradient of the wastewater treatment site and their highest values (i.e., worst water quality) down-gradient of the wastewater treatment site (Zigler 2010, p. 5; Campbell 2011, unpaginated). Data submitted for June 2010, through July 2011, measured the following water quality parameters:

TABLE 2. Water quality from groundwater monitoring wells (mg/L)

Parameter	**Lowest Recorded Value**	**Highest Recorded Value**
Total Inorganic Nitrogen	0.09 (up-gradient well)	10.77 (down-gradient well)
Total Coliform	Less than 1 (both wells)	46 (down-gradient well)
Chloride	6 (up-gradient well)	43.9 (up-gradient well)
Sulfate	16.8 (up-gradient well)	132.2 (down-gradient well)

Parameter	Lowest Recorded Value	Highest Recorded Value
Total Dissolved Solids	142 (up-gradient well)	400 (down-gradient well)

Contaminant inputs can move from groundwater into surface water through the hyporheic zone (Boulton *et al.* 1998, p. 73). Although down-gradient concentrations are elevated, none of the pollutants measured are priority pollutants under the CWA. We cannot make firm conclusions regarding the extent of contamination in the species' habitat caused by wastewater discharge into groundwater 5 to 7 mi (8 to 11 km) upstream without corresponding surface-water quality measurements taken during the summer in lower Elkhorn Creek near known Arapahoe snowfly occupied habitat, when human use upstream is much greater than occurred during the recent winter sampling period. None of the groundwater or surface-water quality information available indicates that nutrient enrichment (high levels of nitrogen or phosphorus), which could lead to algal blooms and decreased dissolved oxygen, is occurring. Wastewater inputs may have modified habitat through nutrient inputs into groundwater within the Elkhorn Creek watershed that could impact the hyporheic zone where Arapahoe snowfly nymphs undergo diapause. However, these inputs occur 5 to 7 mi (8 to 11 km) upstream, and we have only limited water-quality information in the vicinity of the species' known habitat. This data does not indicate nutrient enrichment, but sampling occurred on only one date during the winter, when wastewater inputs are minimal. At present, based upon the best available information, we do not consider wastewater a threat to the species.

Forest Management

In this section we discuss management by the USFS to address the mountain pine beetle; specifically, spraying trees with carbaryl to protect against mountain pine beetle attack and removal of hazardous trees.

Carbaryl is considered one of the most effective and environmentally safe insecticides used to prevent mountain pine beetle attack (Hastings *et al*. 2001, p. 803). Nevertheless, carbaryl poses ecological risks, particularly to honey bees and aquatic invertebrates (U.S. Environmental Protection Agency (EPA) 2004, p. 1). It is rated as "very highly toxic" to aquatic invertebrates, with one of the test organisms a species of stonefly (*Chloroperla grammatica*) (EPA 2004, p. 46). Despite no-spray buffer zones around aquatic habitats, pesticides such as carbaryl may be deposited by drift or mobilized by runoff from upland areas (Beyers *et al*. 1995, p. 27). A study described by Beyers *et al*. (1995, p. 32) found that virtually all stoneflies collected from a stream following carbaryl spraying were dead; however, mortality was likely ameliorated by colonization from unaffected organisms of the same species in the substrate or living upstream. In recent years, the USFS has been spraying carbaryl on thousands of individual trees in the Canyon Lakes Ranger District in an effort to control the ongoing mountain pine beetle outbreak (USFS 2009c, 2010b, 2011a, unpaginated). However, none of the sites sprayed to date are within the Elkhorn Creek watershed (Casamassa 2011, pp. 5–6). Pesticide drift into Arapahoe snowfly habitat is not likely due to the distance from sites that are sprayed. We have no information indicating that the Forest Service intends to spray carbaryl in the Elkhorn Creek watershed in the future, and they

are committed to following label restrictions whenever using this pesticide. Therefore, at present, we do not consider spraying with carbaryl a threat to the species.

The USFS has been removing hazardous trees within the Canyon Lakes Ranger District that have been killed as a result of the mountain pine beetle outbreak (USFS 2009c, 2010b, 2011a, unpaginated). Hazardous trees in this area represent an imminent threat to public health and safety, and largely consist of lodgepole and ponderosa pine. The high percentage of dead trees also increases the amount of forest fuels available during a potential wildfire (USFS 2010a, p. 1). The USFS estimates that approximately 85 percent (48,000 ac (19,000 ha)) of the Arapaho and Roosevelt National Forests have been infested by mountain pine beetles (USFS 2010a, p. 1). Some restrictions regarding tree removal exist within critical habitat for the threatened Preble's meadow jumping mouse (*Zapus hudsonius preblei*). Designated critical habitat for the mouse includes the downstream reaches of both Elkhorn Creek and Young Gulch that contain potential habitat for the Arapahoe snowfly. Mechanical vegetation and slash treatments within critical habitat will occur only during the mouse's hibernation period (November 1–April 30) (USFS 2010a, p. 15). Hand (chainsaw) treatment of vegetation and slash can occur at any time (USFS 2010a, p. 15). No new stream crossings would be allowed in critical habitat (USFS 2010a, p. 16). Adult Arapahoe snowflies have been collected in late March and early April (Mazzacano undated, p. 2), and could potentially be active during removal of hazardous trees.

Ponderosa pines are more common in the upper reaches of Elkhorn Creek than in downstream reaches (Nelson and Kondratieff 1988, p. 79). This lessens the likelihood of tree removal occurring in lower stream reaches in the vicinity of Arapahoe snowfly habitat. Nevertheless, upstream removal of hazardous trees for reasons of public safety and fuel reduction could increase erosion and sediment loading due to soil disturbance near riparian areas (USFS 2010a, p. 40). However, leaving dead trees in place would increase the likelihood of large-scale or high-intensity wildfires due to increased fuel loads (USFS 2010a, p. 44). A wildfire in the vicinity of Arapahoe snowfly habitat could result in extirpation of the species through loss of streamside vegetation important for adult Arapahoe snowfly habitat and as a food source for nymphs and increased sedimentation. Therefore, at present, we do not consider removal of hazardous trees to be a threat to the species as this activity lessens the risk of wildfire. Furthermore, any removal of hazardous trees would likely occur upstream of Arapahoe snowfly habitat.

In conclusion, spraying of carbaryl is currently not implemented within the Elkhorn Creek watershed and, therefore, it is not currently a threat to the Arapahoe snowfly. Removal of hazardous trees may occur in upstream reaches of Elkhorn Creek and could potentially contribute to sediment loading in this stream. However, this activity could be more benefit than harm to the species as it reduces the risk of wildfire. Therefore, at present, we do not consider the forest management practice of hazardous tree removal to be a threat to the species.

Grazing

The USFS manages one active cattle grazing allotment in the Elkhorn Creek watershed (Elkhorn-Lady Moon allotment) (Casamassa 2011, p. 5). The Elkhorn-Lady Moon allotment permits stocking of 75 cow-calf pairs from June 1 through September 30 (USFS 2006a, p. 4). Grazing has been discontinued on a second allotment (Seven Mile allotment) that also includes part of the Elkhorn Creek watershed (USFS 2006a, p. 9).

The effects of cattle grazing on streams have been well documented in the western United States (Clary and Webster 1989, p. 1; Chaney *et al*. 1993, p. 6; Fleischner 1994, p. 629; Belsky *et al*. 1999, p. 419; Agouridis *et al*. 2005, p. 592; Coles-Ritchie *et al*. 2007, p. 733). Cattle are attracted to, and tend to loaf in riparian areas (Roath and Krueger 1982, p. 100; Chaney *et al*. 1993, p. 6; Fleischner 1994, p. 629; Leonard *et al*. 1997, p. 11; Coles-Ritchie *et al*. 2007, p. 738). Grazing cattle can change watershed hydrology, alter stream channel morphology, erode soils, destroy riparian vegetation, impair water quality, and negatively affect aquatic species (Fleischner 1994, p. 635; Agouridis *et al*. 2005, p. 592). Water quality impacts can include increased nutrient levels, bacteria counts, protozoa, sediment loads, and water temperatures and decreased levels of dissolved oxygen (Belsky *et al*. 1999, p. 421). Cattle-impacted streams usually have unstable, trampled streambanks that become significant sources of sediments when they erode, resulting in sediment filling the spaces between cobble in the streambed (embedded streambed), which results in less accessibility to macroinvertebrates, like the Arapahoe snowfly, that use streambed habitat (Braccia and Voshell 2007, p. 198). Stream channel morphology impacts can include decreased channel and streambank

stability during floods, and decreased bed gravel. Hydrology impacts can include decreased late-season flows and water table levels (Belsky *et al*. 1999, pp. 421–422). Impacts to riparian vegetation can include decreased abundance of submerged and emergent higher plants and increased algae (Belsky *et al*. 1999, p. 422). All of these changes can alter the diversity, abundance, and species composition of invertebrate populations, particularly those that require cleaner and colder waters and coarser substrates (Belsky *et al*. 1999, p. 424).

The percentage of stoneflies and other sensitive taxa in a stream has a negative relationship with cattle density (Braccia and Voshell 2007, p. 196; McIver and McInnis 2007, pp. 298 and 301). Higher stocking rates result in greater impacts to streams. Livestock excrement elevates stream water concentrations of inorganic phosphorus and nitrogen, which increases growth of filamentous algae and production by microbes that can reduce dissolved oxygen concentrations (Strand and Merrit 1999, p. 17). Reduced concentrations of dissolved oxygen can adversely affect stonefly nymphs, which have high dissolved oxygen requirements (Williams and Feltmate 1992, p. 39).

A Colorado study in the South Platte River watershed (which includes the Cache la Poudre River) found significantly higher counts of fecal bacteria in stream water at stocking rates of 0.38 cow per ac (0.94 cow per ha) or more (Gary *et al*. 1983, p. 128). As stated above, the grazing allotment on Elkhorn Creek has a much lower stocking rate that permits stocking 75 cow-calf pairs from June 11 through September 30 on 11,605 ac (4,700 ha), or 0.006 cow-calf pair per ac (0.02 cow-calf pair per ha) (USFS 2006b, p. 34;

2007, p. 12; 2011b, p. 1). If only primary range (1,975 ac (800 ha)) within the Elkhorn-Lady Moon allotment, where the majority of grazing occurs, is considered, the stocking rate is higher (0.04 cow-calf pair per ac (0.09 cow-calf pair per ha)), but still much less than the stocking rate of 0.38 cow per ac (0.94 cow per ha) from the study. Therefore, fecal bacteria counts in Elkhorn Creek may not be as elevated as at the study site. Low concentrations (less than established water quality standards) of *E. coli* bacteria have been detected in the Cache la Poudre River during the summer, perhaps due to increased recreation and cattle grazing in the watershed, combined with warmer stream water temperatures that can enhance bacterial survival (Collins and Sprague 2005, p. 1). However, the source of *E. coli* detected in the river is not known.

The Elkhorn-Lady Moon allotment management plan states: (1) livestock will graze a pasture only once in any given year; (2) livestock will be removed when utilization reaches 45 percent on satisfactory upland range or 30 percent on unsatisfactory range; (3) livestock will be removed when stream reaches rated as functional-at-risk reach an average of 6 in. (150 mm) stubble height on tall sedges; and (4) livestock will be removed when streambank disturbance (trampling, exposed soils) reaches 20 to 25 percent of the key area stream reach (USFS 2007, p. 3; 2011b, pp. 1-3). The current grazing plan allows for a five-pasture rotational system (USFS 2007, p. 4). The allotment plan notes that lower reaches of Elkhorn Creek within the allotment have varying degrees of grazing impacts including heavily grazed sedges and hoof shearing along portions of the streambank, resulting in a marginal proper functioning rating (USFS 2007, p. 10). At its closest point, the Elkhorn-Lady Moon allotment is approximately 6 to 7 mi (10 to 11

km) upstream from where the Arapahoe snowfly has been found. Without surface-water quality measurements, taken during the summer grazing season and collected in lower Elkhorn Creek where there is known Arapahoe snowfly habitat, we cannot make firm conclusions regarding the extent of contamination in the species' habitat caused by grazing 6 to 7 mi (10 to 11 km) or further upstream.

In conclusion, grazing may have modified habitat through sediment loading and nutrient inputs into upstream reaches of the Elkhorn Creek watershed. However, stocking rates are light, these inputs occur at least 6 to 7 mi (10 to 11 km) upstream from where the Arapahoe snowfly has been found, and there is no water quality information from the summer grazing season in the vicinity of the species' known habitat to confirm or refute nutrient enrichment. Therefore, at present, we do not consider grazing to be a threat to the species.

Management Plans and Other Conservation Measures

In some instances, there may be conservation measures or management plans that are non-regulatory in nature which may provide benefits to a species.

The CNHP has proposed a Potential Conservation Area (PCA) for the species that would encompass approximately 5,000 ac (2,000 ha) and include downstream portions of both Elkhorn Creek and Young Gulch (Colorado State University 2005, p. 2). This PCA has a Biodiversity Significance Rank of B1 for outstanding biodiversity significance.

This is the highest level of biological diversity that can be assigned to a site. A PCA can provide planning and management guidance, but infers no legal status, and this PCA has only been proposed.

The State of Colorado has had minimum in-stream flow water rights of 2 cfps (0.06 cmps) in Elkhorn Creek since 1978 (CWCB 2010, p. 10). This minimum flow indirectly provides some protection to habitat of the Arapahoe snowfly. However, Elkhorn Creek is described as an intermittent stream (Nelson and Kondratieff 1988, p. 79), and during periods of low precipitation it may be dry, despite in-stream flow water rights. Therefore, minimum flow requirements may be of limited benefit to the species.

Both stream reaches where the Arapahoe snowfly has been located are included in critical habitat for the Preble's meadow jumping mouse, designated on December 15, 2010 (75 FR 78430). Critical habitat extends 394 ft (120 m) from the edges of both streams, and is part of the Cache la Poudre River unit of critical habitat encompassing approximately 4,929 ac (1,995 ha) and 51 mi (82 km) of the river and its tributaries. Section 7(a)(2) of the Act requires Federal agencies to confer with us on any action funded, authorized, or carried out by a Federal agency that is likely to adversely affect the continued existence of the mouse or its designated critical habitat. Examples of specific activities that may adversely affect critical habitat and, therefore, require consultation include: land clearing; road construction; bank stabilization; intensive grazing; water diversions; changes to inputs of water, sediment, and nutrients; or any activity that significantly and detrimentally alters water quantity.

This designation currently provides some indirect protection to the Arapahoe snowfly. The bodies of the streams are not included as critical habitat, although activities in the streams such as water diversions and changes to inputs of water, sediment, and nutrients such as might be caused by hazardous tree removal will require consultation if those activities may adversely affect critical habitat. Actions that do not affect the Preble's meadow jumping mouse or its habitat, or do not involve a Federal agency action, would not require consultation. Federal actions that occurred prior to 2003 did not require consultation because critical habitat for the mouse had not yet been designated. Designation of critical habitat for the Preble's meadow jumping mouse does not protect Arapahoe snowfly occupied habitat from the potential future effects of climate change, nor does it protect the body of Elkhorn Creek from some impacts to water quality that could likely occur without impacting designated critical habitat.

Summary of Factor A

Potential present and threatened future habitat modification caused by climate change is a threat to the Arapahoe snowfly. Climate change is potentially modifying Arapahoe snowfly habitat in several ways including: (1) the threatened reduction in snowpack; (2) the present increase in temperature as well as continued threatened increases in future years; (3) the present outbreak of mountain pine beetle in ponderosa pine; and (4) the threatened increased likelihood of wildfire. Although available information indicates that climate change could potentially be modifying the species'

habitat, we do not have any information that indicates this is currently threatening the species. However, the impacts from each of these stressors are expected to increase into the future. Therefore, we consider threatened habitat modification due to climate change to be a threat to the species.

Development in the Elkhorn Creek watershed includes the construction and use of numerous roads and trails, causing sedimentation that has resulted in a watershed rated as Class II or "at risk." Water diversions from Elkhorn Creek and wastewater inputs into groundwater in the Elkhorn Creek watershed also may be impacting Arapahoe snowfly habitat. However, the extent of impact in the downstream reach where the species occurs has not been determined. Therefore, at present, we do not consider development a threat to the species.

Forest management by the USFS regarding the ongoing mountain pine beetle epidemic includes carbaryl spraying of lodgepole and ponderosa pines to prevent infestations and removal of dead trees that are a potential hazard. However, carbaryl spraying is not occurring in the Elkhorn Creek watershed, and we consider tree removal to pose less of a threat to the Arapahoe snowfly than the increased risk from wildfire if dead trees are not removed. Therefore, at present, we do not consider forest management practices to be a threat to the species.

Some grazing occurs in upstream reaches of the Elkhorn Creek watershed. However, stocking rates are light, these inputs occur at least 6 to 7 mi (10 to 11 km)

upstream from where the Arapahoe snowfly has been found, and we have no water quality information in the vicinity of the species' known habitat to confirm or refute nutrient enrichment. Therefore, at present, we do not consider grazing to be a threat to the species.

There are management plans or other conservation measures that directly or indirectly protect the species, to some degree. However, these cannot protect against habitat modification due to climate change.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes.

We are not aware of any threats due to overutilization of the Arapahoe snowfly for any commercial, recreational, scientific, or educational purposes at this time. We are aware that specimens have been collected for scientific purposes to describe the species and determine its distribution and abundance (Heinold and Kondratieff 2010, p. 281; Heinold 2011d, unpaginated). However, we have no information that suggests these collections were or are occurring at a level that impacts the overall status of the species. Therefore, at present, we do not consider overutilization to be a threat to the species.

Factor C. Disease or Predation.

We are not aware of any diseases that affect the Arapahoe snowfly. Therefore, at present, we do not consider disease to be a threat to the species. We presume that Arapahoe snowfly nymphs and adults may occasionally be subject to predation by certain fish species, such as brook trout (*Salvelinus fontinalis*) or by certain bird species, such as the American dipper (*Cinclus mexicanus*). Both of these species are known to be present in Elkhorn Creek and to consume invertebrates (USFS 2006b, p. 69; eBird 2011, unpaginated). However, nymphs may be protected from most predation due to burrowing into the streambed to undergo diapause, leaving terrestrial adults as the most likely potential prey. However, we have no information that any predation is a threat to the species. Therefore, at present, we do not consider predation to be a threat to the species.

Factor D. Inadequacy of Existing Regulatory Mechanisms.

The Act requires us to examine the adequacy of existing regulatory mechanisms with respect to ongoing and foreseeable threats that place the Arapahoe snowfly at risk of becoming either endangered or threatened. The species currently receives no direct protection under Federal, State, or local law.

The Arapahoe snowfly is designated as "critically imperiled" at both the State and global level by Colorado's Natural Heritage Program (CNHP) and NatureServe, respectively (NatureServe 2009, p. 1). However, this designation does not provide any legal protection for the species or its habitat. See Factor A for a discussion of the CNHP. The Arapahoe snowfly is designated as a "species of greatest conservation need" by the

Colorado Division of Wildlife (CDOW), based upon its global and State ranking by NatureServe and the CNHP (CDOW 2006, pp. 17 and 20). However, this designation also confers no protection to the species from the threats identified in Factors A and E.

The Arapahoe snowfly occurs on USFS lands and is indirectly protected by Federal laws and regulations mandating how USFS lands are managed. The Land and Resource Management Plan (LRMP) for the Arapaho and Roosevelt National Forests and Pawnee National Grassland was prepared in accordance with the National Forest Management Act of 1976 (NFMA), the regulatory mechanism directing the administration and management of national forests. One of the goals of the LRMP is to restore, protect, and enhance habitats for endangered, threatened, and proposed species listed in accordance with the Act, as well as sensitive species appearing on the regional sensitive species list to contribute to their stabilization and full recovery (USFS 1997, p. 17). Habitat on USFS lands is managed to help assure that species whose viability is a concern survive throughout their range, that populations increase or stabilize, or that threats are eliminated (USFS 1997, p. 7). However, the species is not currently listed under the Act, and it is not on the USFS sensitive species list. Consequently, it currently receives no direct protection under the USFS LRMP. The management authorities that USFS has available are not adequate to protect the species from the primary threats of climate change and small population size (see Factor E).

All Federal agencies are required to adhere to the National Environmental Policy Act (NEPA) of 1970 (42 U.S.C. 4321 *et seq*.) for projects they fund, authorize, or carry

out. The Council on Environmental Quality's regulations for implementing NEPA (40 CFR 1500–1518) state that when preparing environmental impact statements, agencies must include a discussion on the environmental impacts of the various project alternatives, any adverse environmental effects that cannot be avoided, and any irreversible or irretrievable commitments of resource involved. Additionally, activities on non-Federal lands are subject to NEPA if there is a Federal action. The NEPA is a disclosure law, and does not require subsequent minimization or mitigation measures by the Federal agency involved. Although Federal agencies may include conservation measures for sensitive species as a result of the NEPA process, any such measures are typically voluntary in nature and not required by the statute.

On December 15, 2009, the EPA published in the **Federal Register** (74 FR 66496) a rule titled, "Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act." In this rule, the EPA Administrator found that the current and projected concentrations of the six long-lived and directly emitted greenhouse gases—carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—in the atmosphere threaten the public health and welfare of current and future generations; and that the combined emissions of these greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the greenhouse gas pollution that threatens public health and welfare (74 FR 66496). In effect, the EPA has concluded that the greenhouse gases linked to climate change are pollutants, whose emissions can now be subject to the Clean Air Act (42 U.S.C. 7401 *et seq.*; see 74 FR 66496). However, specific regulations to limit greenhouse gas emissions were only proposed in 2010 and, therefore, cannot be considered an existing regulatory

mechanism. At present, we have no basis to conclude that implementation of the Clean Air Act in the foreseeable future (40 years, based on global climate projections) will substantially reduce the current rate of global climate change through regulation of greenhouse gas emissions. Thus, we conclude that the Clean Air Act is not designed to address the primary threats to the Arapahoe snowfly, namely the anticipated loss of thermally and hydrologically suitable habitat as a result of increasing water temperatures and reduced snowpack changes that result from climate change in the Elkhorn Creek watershed, Colorado.

Combined with the threats discussed under Factor A, the species' small population size makes the species more vulnerable to extinction due to demographic stochasticity, environmental stochasticity, and random catastrophe (discussed under Factor E). We are not aware of any regulatory mechanisms that address threats caused by small population size for this species.

Summary of Factor D

There are no regulatory mechanisms that directly protect the Arapahoe snowfly at the Federal, State, or local level. The species is indirectly protected by Federal laws and regulations mandating how USFS lands are managed. These regulatory mechanisms cannot protect against climate change or a small population size (discussed under Factor E). We consider habitat loss and modification resulting from the environmental changes due to climate change to constitute a primary threat to the species. The United States is

only now beginning to address global climate change through the regulatory process (e.g., Clean Air Act). We have no information on what regulations may eventually be adopted and when implemented. We are not aware of any regulatory mechanisms that address the changes in Arapahoe snowfly habitat that are occurring or likely to occur in the future. Additionally, we are not aware of any regulations that address threats caused by small population size.

Factor E. Other Natural or Manmade Factors Affecting its Continued Existence.

Under this factor we consider the small population size of the Arapahoe snowfly. As discussed in the section on Historic Distribution, the species has been extirpated from Young Gulch, one of the two streams where it was known to occur. Based upon the best available information, it appears to currently have an extremely narrow distribution near the confluence of Elkhorn Creek with the Cache la Poudre River, and appears rare within its only known occupied habitat.

A species may be considered rare because of a limited geographical range, specialized habitat, or small population size (Primack 1998, p. 176). The Arapahoe snowfly appears to have a very limited occupied range (approximately 1,640 ft (500 m) along 1 stream) and a very small population size (13 males and 2 females have been collected in the past 25 years). It has several characteristics typical of species vulnerable to extinction including: (1) a very narrow geographical range; (2) only one known population; (3) a small population size; (4) an ineffective disperser; (5) a seasonal

migrant depending on two or more distinct habitat types to complete its life cycle; and (6) characteristically found in stable, pristine environments (Primack 1998, pp. 178–187).

Extinction may be caused by demographic stochasticity due to chance realizations of individual probabilities of death and reproduction, particularly in small populations (Shaffer 1981, p. 131; Lande 1993, pp. 911–912). Environmental stochasticity can result in extinction through a series of small or moderate perturbations that affect birth and death rates within a population (Shaffer 1981, p. 131; Lande 1993, p. 912). Lastly, extinction can be caused by random catastrophes (Shaffer 1981, p. 131; Lande 1993, p. 912). The Arapahoe snowfly is vulnerable to extinction due to: (1) demographic stochasticity due to its small population size; (2) environmental stochasticity due to continued small perturbations caused by ongoing modification and curtailment of its habitat and range; and (3) the chance of random catastrophe such as wildfire.

Small populations also can be vulnerable due to a lack of genetic diversity (Shaffer 1981, p. 132). We have no information regarding genetic diversity of the Arapahoe snowfly. A minimum viable population (MVP) will vary depending on the species. An MVP of 1,000 may be adequate for species of normal genetic variability, and an MVP of 10,000 should permit long-term persistence and continued genetic diversity (Thomas 1990, p. 325). These estimates should be increased by at least 1 order of magnitude (to 10,000 and 100,000) for insects because they usually have greater population variability (Thomas 1990, p. 326). Based upon available information, the

Arapahoe snowfly likely does not meet these minimum population criteria for maintaining genetic diversity.

Summary of Factor E

We consider the Arapahoe snowfly to be rare due to its extremely limited range, a single known extant population, and its small population size. It also is an ineffective disperser, a seasonal migrant depending on two or more distinct habitat types to complete its life cycle, and it requires a pristine environment to carry out life history functions. The restricted range of the species does not necessarily constitute a threat in itself. However, combined with the threats discussed under Factor A, the species' small population size makes the species more vulnerable to extinction due to demographic stochasticity, environmental stochasticity, and random catastrophe. The presence of specific threats including climate change increases the vulnerability of this small population. Therefore, at present, we consider its small population size to be a threat to the species.

Finding

As required by the Act, we considered the five factors in assessing whether the Arapahoe snowfly is threatened or endangered throughout all of its range. We examined the best scientific and commercial information available regarding the past, present, and future threats faced by the species. We reviewed the petition, information available in

our files, other available published and unpublished information, and we consulted with recognized species experts and other Federal and State agencies.

This status review identified threats to the Arapahoe snowfly attributable to Factors A, D, and E. Potential present and threatened habitat modification caused by climate change is impacting the Elkhorn Creek watershed. We also find that the species is at risk due to its small population size. Existing regulatory mechanisms are not designed to protect the species from threats identified under Factors A and E. The following table summarizes the conclusions from our five factor analysis:

TABLE 3. Summary of the Act's five factor analysis for the Arapahoe snowfly, Elkhorn Creek.

Factor / Stressor	**Threat Conclusion**
Factor A:	
Climate Change:	
Reduced Snowpack	Future threat
Increased Temperature	Ongoing and future threat
Mountain Pine Beetle	Ongoing and future threat
Wildfire	Future threat
Recreational Use	Present, but not a threat
Development:	
Roads	Present, but not a threat
Water Diversions	Present, but not a threat
Wastewater Inputs	Present, but not a threat
Forest Management:	
Carbaryl Spraying	Not present, not a threat
Hazardous Tree Removal	Present, but not a threat
Grazing	Present, but not a threat
Factor B:	
Overutilization	Present, but not a threat
Factor C:	
Disease	Not present, not a threat
Predation	Present, but not a threat

Factor / Stressor	Threat Conclusion
Factor D: Inadequate Regulatory Mechanisms	No mechanisms existing or designed to address threats
Factor E: Small Population Size	Ongoing and future threat

On the basis of the best scientific and commercial information available, we find that the petitioned action is warranted. We will make a determination on the status of the species as threatened or endangered when we do a proposed listing determination. However, as explained in more detail below, an immediate proposal of a regulation implementing this action is precluded by higher priority listing actions, and expeditious progress is being made to add or remove qualified species from the Lists of Endangered and Threatened Wildlife and Plants.

We reviewed the available information to determine if the existing and foreseeable threats render the species at risk of extinction now such that issuing an emergency regulation temporarily listing the Arapahoe snowfly under section 4(b)(7) of the Act is warranted. We determined that issuing an emergency regulation temporarily listing the species is not warranted for this species at this time, because the species is not under immediate threat of extinction. Impacts from climate change, a small population size, and lack of adequate regulatory mechanisms are cumulative, and will develop in intensity and scope over time. However, if at any time we determine that issuing an emergency regulation temporarily listing the Arapahoe snowfly is warranted, we will initiate this action at that time.

Listing Priority Number

The Service adopted guidelines on September 21, 1983 (48 FR 43098), to establish a rational system for utilizing available resources for the highest priority species when adding species to the Lists of Endangered or Threatened Wildlife and Plants or reclassifying species listed as threatened to endangered status. These guidelines, titled "Endangered and Threatened Species Listing and Recovery Priority Guidelines," address the magnitude and immediacy of threats and the level of taxonomic distinctiveness by assigning priority in descending order to monotypic genera (genus with one species), full species, and subspecies (or equivalently distinct population segments of vertebrates). Listing Priority Numbers (LPNs) range from 1 to 12, with an LPN of 1 representing the highest priority. We assign the Arapahoe snowfly an LPN of 5 based on our finding that this is a species facing threats that are of high magnitude, but those threats are not imminent. These threats include the present or threatened destruction, modification, or curtailment of its habitat, the inadequacy of existing regulatory mechanisms, and its small population size. Our rationale for assigning the Arapahoe snowfly an LPN of 5 is outlined below.

Under the Service's LPN Guidance, the magnitude of threat is the first criterion we look at when establishing a listing priority. The guidance indicates that species with the highest magnitude of threat are those species facing the greatest threats to their continued existence. These species receive the highest priority. Threats to the Arapahoe snowfly are of high magnitude because climate change, inadequate regulatory

mechanisms, and a small population size occur throughout the range of the species. The species has not been located in Young Gulch since 1986 and, despite repeated searches, has not been located in other nearby tributaries, leaving one small known population along a reach of Elkhorn Creek of approximately 1,640 ft (500 m).

Under our LPN Guidance, the second criterion we consider in assigning a listing priority is the immediacy of threats. This criterion is intended to ensure that the species facing actual, identifiable threats are given priority over those species for which threats are only potential or species that are intrinsically vulnerable, but are not known to be presently facing such threats. We consider the threats to the Arapahoe snowfly overall to be non-imminent because: (1) although increases in temperature in excess of those known to adversely impact stoneflies have been documented in the northern Front Range of Colorado, we have no information to indicate that the species has actually been adversely affected by these temperatures; and (2) a single small population with a very limited range results in increased vulnerability to extirpation caused by threats from climate change and sedimentation; however, the species has been located in Elkhorn Creek on three occasions since 1987. While regulatory mechanisms are currently inadequate to protect the species from the previously described threats, these impacts do not appear to be affecting the existing population in Elkhorn Creek, though they may be precluding reestablishment in the Young Gulch watershed.

These actual, identifiable threats are covered in detail under the discussion of Factors A, D, and E of this finding. We previously acknowledged that few studies have been conducted on the Arapahoe snowfly due to its rarity, the difficulties in

distinguishing among species of snowfly nymphs, and difficulties of sampling under ice in winter. Consequently, most of the best available information regarding specific impacts caused by the various threats comes from our knowledge about stoneflies (order Plecoptera) in general, other members of winter stonefly (family Capniidae), and other species of snowfly (genus *Capnia*). Due to the extreme rarity of the Arapahoe snowfly, species-specific research is not likely to be conducted, and we do not consider it appropriate to defer this finding until research is conducted. The available data shows adverse impacts from these threats for closely related species.

The third criterion in our LPN guidance is intended to devote resources to those species representing highly distinctive or isolated gene pools as reflected by taxonomy. The Arapahoe snowfly is a valid taxon at the species level and, therefore, receives a higher priority than a subspecies, but a lower priority than a species in a monotypic genus. The Arapahoe snowfly faces high-magnitude, nonimminent threats, and is a valid taxon at the species level. Thus, in accordance with our LPN guidance, we have assigned the Arapahoe snowfly an LPN of 5.

We will continue to monitor the threats to the Arapahoe snowfly and the species' status on an annual basis, and should the magnitude or the imminence of the threats change, we will revisit our assessment of the LPN.

Work on a proposed listing determination for the Arapahoe snowfly is precluded by work on higher priority listing actions with absolute statutory, court-ordered, or court-

approved deadlines and final listing determinations for those species that were proposed for listing with funds from Fiscal Year 2012. This work includes all the actions listed in the tables below under expeditious progress.

Preclusion and Expeditious Progress

Preclusion is a function of the listing priority of a species in relation to the resources that are available and the cost and relative priority of competing demands for those resources. Thus, in any given fiscal year (FY), multiple factors dictate whether it will be possible to undertake work on a listing proposal regulation or whether promulgation of such a proposal is precluded by higher priority listing actions. We make our determinations of preclusion on a nationwide basis to ensure that the species most in need of listing will be addressed first and also because we allocate our listing budget on a nationwide basis.

Available Resources

Congress identified the availability of resources as the only basis for deferring the initiation of a rulemaking that is warranted. The Conference Report accompanying Pub. L. 97-304 (Endangered Species Act Amendments of 1982), which established the current statutory deadlines and the warranted-but-precluded finding, states that the amendments were "not intended to allow the Secretary to delay commencing the rulemaking process for any reason other than that the existence of pending or imminent proposals to list species subject to a greater degree of threat would make allocation of resources to such a petition [that is, for a lower-ranking species] unwise." Although that statement appeared

to refer specifically to the "to the maximum extent practicable" limitation on the 90-day deadline for making a "substantial information" finding, that finding is made at the point when the Service is deciding whether or not to commence a status review that will determine the degree of threats facing the species, and therefore the analysis underlying the statement is more relevant to the use of the warranted-but-precluded finding, which is made when the Service has already determined the degree of threats facing the species and is deciding whether or not to commence a rulemaking.

The resources available for listing actions are determined through the annual Congressional appropriations process. The appropriation for the Listing Program is available to support work involving the following listing actions: Proposed and final listing rules; 90-day and 12-month findings on petitions to add species to the Lists of Endangered and Threatened Wildlife and Plants (Lists) or to change the status of a species from threatened to endangered; annual "resubmitted" petition findings on prior warranted-but-precluded petition findings as required under section 4(b)(3)(C)(i) of the Act; critical habitat petition findings; proposed and final rules designating critical habitat; and litigation-related, administrative, and program-management functions (including preparing and allocating budgets, responding to Congressional and public inquiries, and conducting public outreach regarding listing and critical habitat). The work involved in preparing various listing documents can be extensive and may include, but is not limited to: Gathering and assessing the best scientific and commercial data available and conducting analyses used as the basis for our decisions; writing and publishing documents; and obtaining, reviewing, and evaluating public comments and peer review

comments on proposed rules and incorporating relevant information into final rules. The number of listing actions that we can undertake in a given year also is influenced by the complexity of those listing actions; that is, more complex actions generally are more costly. The median cost for preparing and publishing a 90-day finding is $39,276; for a 12-month finding, $100,690; for a proposed rule with critical habitat, $345,000; and for a final listing rule with critical habitat, $305,000.

We cannot spend more than is appropriated for the Listing Program without violating the Anti-Deficiency Act (see 31 U.S.C. 1341(a)(1)(A)). In addition, in FY 1998 and for each fiscal year since then, Congress has placed a statutory cap on funds that may be expended for the Listing Program, equal to the amount expressly appropriated for that purpose in that fiscal year. This cap was designed to prevent funds appropriated for other functions under the Act (for example, recovery funds for removing species from the Lists), or for other Service programs, from being used for Listing Program actions (see House Report 105-163, 105th Congress, 1st Session, July 1, 1997).

Since FY 2002, the Service's budget has included a critical habitat subcap to ensure that some funds are available for other work in the Listing Program ("The critical habitat designation subcap will ensure that some funding is available to address other listing activities" (House Report No. 107 - 103, 107th Congress, 1st Session, June 19, 2001)). In FY 2002 and each year until FY 2006, the Service has had to use virtually the entire critical habitat subcap to address court-mandated designations of critical habitat, and consequently none of the critical habitat subcap funds have been available for other

listing activities. In some FYs since 2006, we have been able to use some of the critical habitat subcap funds to fund proposed listing determinations for high-priority candidate species. In other FYs, while we were unable to use any of the critical habitat subcap funds to fund proposed listing determinations, we did use some of this money to fund the critical habitat portion of some proposed listing determinations so that the proposed listing determination and proposed critical habitat designation could be combined into one rule, thereby being more efficient in our work. At this time, for FY 2012, we are using some of the critical habitat subcap funds to fund proposed listing determinations.

Through the listing cap, the critical habitat subcap, and the amount of funds needed to address court-mandated critical habitat designations, Congress and the courts have in effect determined the amount of money available for other listing activities nationwide. Therefore, the funds in the listing cap, other than those needed to address court-mandated critical habitat for already listed species, set the limits on our determinations of preclusion and expeditious progress.

Preclusion

For FY 2012, on December 23, 2011, Congress passed a Consolidated Appropriations Act (Pub. L., 112-74) which provides funding through the end of the fiscal year. The Service has $20,902,000 for the listing program. Of that, no more than $7,472,000 is available for determinations of critical habitat for already listed species. In addition, while no more than $1,500,000 can be used for listing, delisting, and

reclassification actions for foreign species, $500,000 is being allocated for work on foreign species. The Service thus has $12,930,000 available to fund work on listing actions other than critical habitat designation and work on foreign species. The following are categories of work for which listing funds are being used: (1) Compliance with court orders and court-approved settlement agreements requiring that petition findings or listing determinations be completed by a specific date; (2) section 4 (of the Act) listing actions with absolute statutory deadlines; and (3) essential litigation-related, administrative, and listing program-management functions. In FY 2010, the Service received many new petitions and a single petition to list 404 species, increasing our workload significantly. Additionally, as a result of a settlement agreement, we are implementing a work plan that establishes a framework and schedule for resolving by September 30, 2016, the status of all of the species that the Service had determined to be qualified as of the 2010 Candidate Notice of Review. The Service submitted such a work plan to the U.S. District Court for the District of Columbia in *In re Endangered Species Act Section 4 Deadline Litigation*, No. 10-377 (EGS), MDL Docket No. 2165 (D. D.C. May 10, 2011), and obtained the court's approval. In FY 2012, our entire listing budget has been allocated for work in the above categories, primarily including work under this settlement agreement. The budget allocations for each specific listing action are identified in the Service's FY 2012 Allocation Tables (part of our record). Thus, funding a proposed listing determination for the Arapahoe snowfly is precluded by our lack of available resources.

Based on our September 21, 1983, guidelines for assigning an LPN for each candidate species (48 FR 43098), we assign each candidate an LPN of 1 to 12, depending on the magnitude of threats (high or moderate to low), immediacy of threats (imminent or nonimminent), and taxonomic status of the species (in order of priority: monotypic genus (a species that is the sole member of a genus); species; or part of a species (subspecies, or distinct population segment)). The lower the listing priority number, the higher the listing priority (that is, a species with an LPN of 1 would have the highest listing priority). A species with a higher LPN would generally be precluded from listing by species with lower LPNs, unless work on a proposed rule for the species with the higher LPN can be combined with work on a proposed rule for other high-priority species. This is not the case for Arapahoe snowfly. Thus, in addition to being precluded by the lack of available resources, the Arapahoe snowfly with an LPN of 5 is also precluded by work on proposed listing determinations for those candidate species with a higher listing priority.

Finally, proposed rules for reclassification of threatened species to endangered species are lower priority, because as listed species, they are already afforded the protections of the Act and implementing regulations. However, for efficiency reasons, we may choose to work on a proposed rule to reclassify a species to endangered if we can combine this with work that is subject to a court-determined deadline.

With our workload much larger than the amount of funds we have to accomplish it, it is important that we be as efficient as possible in our listing process. Therefore, as

we implement our listing work plan and work on proposed rules for the highest priority species in the next several years, we are preparing multi-species proposals when appropriate, and these may include species with lower priority if they overlap geographically or have the same threats as a species with an LPN of 2. In addition, we take into consideration the availability of staff resources when we determine which high-priority species will receive funding to minimize the amount of time and resources required to complete each listing action.

Expeditious Progress

As explained above, a determination that listing is warranted but precluded must also demonstrate that expeditious progress is being made to add and remove qualified species to and from the Lists of Endangered and Threatened Wildlife and Plants. As with our "precluded" finding, the evaluation of whether progress in adding qualified species to the Lists has been expeditious is a function of the resources available for listing and the competing demands for those funds. (Although we do not discuss it in detail here, we are also making expeditious progress in removing species from the list under the Recovery program in light of the resource available for delisting, which is funded by a separate line item in the budget of the Endangered Species Program. To date, during FY 2012, we completed delisting rules for one species.) Given the limited resources available for listing, we find that we are making expeditious progress in FY 2012 in the Listing Program. This progress included preparing and publishing the following determinations:

FY 2012 Completed Listing Actions			
Publication Date	Title	Actions	FR Pages
10/4/2011	12-Month Finding on a Petition to List the Lake Sammamish Kokanee Population of *Oncorhynchus nerka* as an Endangered or Threatened Distinct Population Segment	Notice of 12-month petition finding, Not warranted	76 FR 61298-61307
10/4/2011	12-Month Finding on a Petition to List *Calopogon oklahomensis* as Threatened or Endangered	Notice of 12-month petition finding, Not warranted	76 FR 61307-61321
10/4/2011	12-Month Finding on a Petition To List the Amargosa River Population of the Mojave Fringe-toed Lizard as an Endangered or Threatened Distinct Population Segment	Notice of 12-month petition finding, Not warranted	76 FR 61321-61330
10/4/2011	Endangered Status for the Alabama Pearlshell, Round Ebonyshell, Southern Sandshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Status for the Tapered Pigtoe, Narrow Pigtoe, and Fuzzy Pigtoe; with Critical Habitat	Proposed Listing Endangered	76 FR 61482-61529
10/4/2011	90-Day Finding on a Petition To List 10 Subspecies of Great Basin Butterflies as Threatened or Endangered with Critical Habitat	Notice of 90-day Petition Finding, Substantial and Not substantial	76 FR 61532-61554
10/5/2011	90-Day Finding on a Petition to List 29 Mollusk Species as Threatened or Endangered With Critical Habitat	Notice of 90-day Petition Finding, Substantial and Not substantial	76 FR 61826-61853
10/5/2011	12-Month Finding on a Petition to List the Cactus Ferruginous Pygmy-Owl as Threatened or Endangered with Critical Habitat	Notice of 12-month petition finding, Not warranted	76 FR 61856-61894
10/5/2011	12-Month Finding on a Petition to List the Northern Leopard Frog in the Western United States as	Notice of 12-month petition finding, Not	76 FR 61896-61931

	Threatened	warranted	
10/6/2011	Endangered Status for the Ozark Hellbender Salamander	Final Listing Endangered	76 FR 61956-61978
10/6/2011	Red-Crowned Parrot	Notice of 12-month petition finding, Warranted but precluded	76 FR 62016-62034
10/6/2011	12-Month Finding on a Petition to List Texas Fatmucket, Golden Orb, Smooth Pimpleback, Texas Pimpleback, and Texas Fawnsfoot as Threatened or Endangered	Notice of 12-month petition finding, Warranted but precluded	76FR 62166-62212
10/6/2011	12-Month Finding on a Petition to List the Mohave Ground Squirrel as Endangered or Threatened	Notice of 12-month petition finding, Not warranted	76 FR 62214-62258
10/6/2011	Partial 90-Day Finding on a Petition to List 404 Species in the Southeastern United States as Threatened or Endangered With Critical Habitat	Notice of 90-day Petition Finding, Not substantial	76 FR 62260-62280
10/7/2011	12-Month Finding on a Petition to List the Black-footed Albatross as Endangered or Threatened	Notice of 12-month petition finding, Not warranted	76 FR 62504-62565
10/11 /2011	12-Month Finding on a Petition to List *Amoreuxia gonzalezii, Astragalus hypoxylus,* and *Erigeron piscaticus* as Endangered or Threatened	Notice of 12-month petition finding, Not warranted	76 FR 62722-62740
10/11/2011	12-Month Finding on a Petition and Proposed Rule to List the Yellow-Billed Parrot	Notice of 12-month petition finding, Warranted Propose Listing, threatened	76 FR 62740-62754
10/11/2011	12-Month Finding on a Petition to List the Tehachapi Slender Salamander as Endangered or	Notice of 12-month petition finding, Not warranted	76 FR 62900-62926

	Threatened		
10/11/2011	Endangered Status for the Altamaha Spinymussel and Designation of Critical Habitat	Final Listing Endangered	76 FR 62928-62960
10/11/2011	12-Month Finding for a Petition to List the California Golden Trout as Endangered	Notice of 12-month petition finding, Not warranted	76 FR 63094-63115
10/12/2011	12-Month Petition Finding, Proposed Listing of Coquí Llanero as Endangered, and Designation of Critical Habitat for Coquí Llanero	Notice of 12-month petition finding, Warranted; Proposed Listing Endangered	76 FR 63420-63442
10/12/2011	12-Month Finding on a Petition to List Northern Leatherside Chub as Endangered or Threatened	Notice of 12-month petition finding, Not warranted	76 FR 63444-63478
10/12/2011	12-Month Finding on a Petition to List Two South American Parrot Species	Notice of 12-month petition finding, Not warranted	76 FR 63480-63508
10/13/2011	12-Month Finding on a Petition to List a Distinct Population Segment of the Red Tree Vole as Endangered or Threatened	Notice of 12-month petition finding, Warranted but precluded	76 FR 63720-63762
12/19/2011	90-Day Finding on a Petition To List the Western Glacier Stonefly as Endangered With Critical Habitat	Notice of 90-day Petition Finding, Substantial	76 FR 78601-78609
1/3/2012	90-Day Finding on a Petition to List Sierra Nevada Red Fox as Endangered or Threatened	Notice of 90-day Petition Finding, Substantial	77 FR 45-52
1/5/2012	Listing Two Distinct Population Segments of Broad-Snouted Caiman as Endangered or Threatened and a Special Rule	Proposed Reclassification	77 FR 666-697
1/12/2012	90-Day Finding on a Petition To List the Humboldt Marten as Endangered or	Notice of 90-day Petition Finding, Substantial	77 FR 1900-1908

	Threatened		
1/24/2012	90-Day Finding on a Petition to List the 'I'iwi as Endangered or Threatened	Notice of 90-day Petition Finding, Substantial	77 FR 3423-3432
2/1/2012	90-Day Finding on a Petition to List the San Bernardino Flying Squirrel as Endangered or Threatened With Critical Habitat	Notice of 90-day Petition Finding, Substantial	77 FR 4973-4980
2/14/2012	Determination of Endangered Status for the Rayed Bean and Snuffbox Mussels Throughout Their Ranges	Final Listing Endangered	77 FR 8632-8665
2/17/2012	90-Day Finding on a Petition to List the Thermophilic Ostracod as Endangered or Threatened	Notice of 90-day Petition Finding, Not substantial	77 FR 9618-9619
3/13/2012	Determination of Endangered Status for the Sheepnose and Spectaclecase Mussels Throughout Their Range	Final Listing Endangered	77 FR 14914-14949
4/2/2012	12-month Finding on a Petition to List the San Francisco Bay-Delta Population of the Longfin Smelt as Endangered or Threatened	Notice of 12-month petition finding, Warranted but precluded	77 FR 19756 - 19797
4/6/2012	Listing of the Miami Blue Butterfly as Endangered Throughout Its Range; Listing of the Cassius Blue, Ceraunus Blue, and Nickerbean Blue Butterflies as Threatened Due to Similarity of Appearance to the Miami Blue Butterfly in Coastal South and Central Florida	Final Listing Endangered	77 FR 20948-20986
4/12/2012	90–Day Finding on a Petition to List Either the Eastern Population or the Southern Rocky Mountain Population of the Boreal Toad as an Endangered or Threatened Distinct Population Segment	Notice of 90-day Petition Finding, Substantial	77 FR 21920-21936

4/17/2012	Determination of Endangered Status for Three Forks Springsnail and Threatened Status for San Bernardino Springsnail Throughout Their Ranges and Designation of Critical Habitat for Both Species	Final Listing Endangered and Threatened	77 FR 23060-23092

Our expeditious progress also includes work on listing actions that we funded in previous fiscal years and in FY 2012 but have not yet been completed to date. These actions are listed below. Actions in the top section of the table are being conducted under a deadline set by a court through a court order or settlement agreement. The Service had already begun to implement our work plan submitted as part of the MDL settlement case (see above) last FY and we continue to work on these actions. Many of these initial actions in our work plan include work on proposed rules for candidate species with an LPN of 2 or 3. As discussed above, selection of the order in which these species are worked on is partially based on available staff resources, and when appropriate, include species with a lower priority if they overlap geographically or have the same threats as the species with the high priority. Including these species together in the same proposed rule results in considerable savings in time and funding, when compared to preparing separate proposed rules for each of them in the future. Actions in the lower section of the table are being conducted to meet statutory timelines, that is, timelines required under the Act.

Actions funded in Previous FYs and in FY 2012 but not yet completed	
Species	**Action**
Actions Subject to Court Order/Settlement Agreement	
4 parrot species (military macaw, yellow-	12-month petition finding

billed parrot, scarlet macaw)[5]	
20 Maui-Nui candidate species[2] (17 plants, 3 tree snails) (14 with LPN = 2, 2 with LPN = 3, 3 with LPN = 8)	Proposed listing
Umtanum buckwheat (LPN = 2) and white bluffs bladderpod (LPN = 9)[4]	Proposed listing
Grotto sculpin (LPN = 2)[4]	Proposed listing
2 Arkansas mussels (Neosho mucket (LPN =2) & Rabbitsfoot (LPN = 9))[4]	Proposed listing
Diamond darter (LPN = 2)[4]	Proposed listing
Gunnison sage-grouse (LPN =2)[4]	Proposed listing
Coral Pink Sand Dunes Tiger Beetle (LPN = 2)[5]	Proposed listing
Lesser prairie chicken (LPN = 2)	Proposed listing
4 Texas salamanders (Austin blind salamander (LPN = 2), Salado salamander (LPN = 2), Georgetown salamander (LPN = 8), Jollyville Plateau (LPN = 8))[3]	Proposed listing
West Texas aquatics (Gonzales Spring Snail (LPN = 2), Diamond Y springsnail (LPN =2), Phantom springsnail (LPN = 2), Phantom Cave snail (LPN = 2), Diminutive amphipod (LPN = 2))[3]	Proposed listing
2 Texas plants (Texas golden gladecress (*Leavenworthia texana*) (LPN = 2), Neches River rose-mallow (*Hibiscus dasycalyx*) (LPN = 2))[3]	Proposed listing
4 AZ plants (Acuna cactus (*Echinomastus erectocentrus* var. *acunensis*) (LPN = 3), Fickeisen plains cactus (*Pediocactus peeblesianus fickeiseniae*) (LPN = 3), Lemmon fleabane (*Erigeron lemmonii*) (LPN = 8), Gierisch mallow (*Sphaeralcea gierischii*) (LPN =2))[5]	Proposed listing
FL bonneted bat (LPN =2)[3]	Proposed listing
3 Southern FL plants (Florida semaphore	Proposed listing

cactus (*Consolea corallicola*) (LPN = 2), shellmound applecactus (*Harrisia* (=*Cereus*) *aboriginum* (=*gracilis*)) (LPN = 2), Cape Sable thoroughwort (*Chromolaena frustrata*) (LPN = 2))[5]	
21 Big Island (HI) species[5] (includes 8 candidate species – 6 plants & 2 animals; 4 with LPN = 2, 1 with LPN = 3, 1 with LPN = 4, 2 with LPN = 8)	Proposed listing
12 Puget Sound prairie species (9 subspecies of pocket gopher (*Thomomys mazama* ssp.) (LPN =3), streaked horned lark (LPN = 3), Taylor's checkerspot (LPN = 3), Mardon skipper (LPN = 8))[3]	Proposed listing
2 TN River mussels (fluted kidneyshell (LPN = 2), slabside pearlymussel (LPN = 2))[5]	Proposed listing
Jemez Mountain salamander (LPN = 2)[5]	Proposed listing
Actions with Statutory Deadlines	
5 Bird species from Colombia and Ecuador	Final listing determination
Queen Charlotte goshawk	Final listing determination
6 Birds from Peru & Bolivia	Final listing determination
Loggerhead sea turtle (assist National Marine Fisheries Service)[5]	Final listing determination
Platte River caddisfly (from 206 species petition)[5]	12-month petition finding
Ashy storm-petrel[5]	12-month petition finding
Honduran emerald	12-month petition finding
Eagle Lake trout[1]	90-day petition finding
Spring Mountains checkerspot butterfly	90-day petition finding
Aztec gilia[5]	90-day petition finding
White-tailed ptarmigan[5]	90-day petition finding
Bicknell's thrush[5]	90-day petition finding

Sonoran talussnail[5]	90-day petition finding
2 AZ Sky Island plants (*Graptopetalum bartrami* & *Pectis imberbis*)[5]	90-day petition finding
Desert massasauga	90-day petition finding
Alexander Archipelago wolf[5]	90-day petition finding
Eastern diamondback rattlesnake	90-day petition finding

[1] Funds for listing actions for these species were provided in previous FYs.
[2] Although funds for these high-priority listing actions were provided in FY 2008 or 2009, due to the complexity of these actions and competing priorities, these actions are still being developed.
[3]Partially funded with FY 2010 funds and FY 2011 funds.
[4] Funded with FY 2010 funds.
[5]Funded with FY 2011 funds.

We have endeavored to make our listing actions as efficient and timely as possible, given the requirements of the relevant law and regulations, and constraints relating to workload and personnel. We are continually considering ways to streamline processes or achieve economies of scale, such as by batching related actions together. Given our limited budget for implementing section 4 of the Act, these actions described above collectively constitute expeditious progress.

The Arapahoe snowfly will be added to the list of candidate species upon publication of this 12-month finding. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

We intend that any proposed listing action for the Arapahoe snowfly will be as accurate as possible. Therefore, we will continue to accept additional information and comments from all concerned governmental agencies, the scientific community, industry, or any other interested party concerning this finding.

References Cited

A complete list of references cited is available on the Internet at *http://www.regulations.gov* and upon request from the Colorado Field Office (see **ADDRESSES** section).

Authors

The primary authors of this notice are the staff members of the Colorado Field Office and the Mountain-Prairie Regional Office.

Authority

The authority for this section is section 4 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Dated: May 1, 2012

/s/ David L. Cottingham

Acting Director, Fish and Wildlife Service

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